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(54) **Pneumatic tire**

Luftreifen

Bandage pneumatique

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EP 1 174 289 B1

Description

[0001] This invention relates to a pneumatic tire, and more particularly to an improvement of a bead portion in a heavy duty pneumatic tire provided with a bead core having a polygonal form at its cross section.

[0002] In a bead portion of a heavy duty pneumatic tire, a portion of a carcass is wound around a bead core having, for example, a hexagonal form at its cross section from an inside of the tire toward an outside thereof in a radial direction and a bead filler is arranged above an outer periphery of the bead core between a main portion of the carcass and a turnup portion thereof. For the purpose of enhancing the rigidity of the bead portion and hence rigidities in all directions of the tire, it is widely and generally practiced to arrange at least one chafer made of nylon cords, steel wires or the like along the bead filler.

[0003] In the conventional chafer, a plurality of nylon cords, steel wires or the like are extended at a state of slightly inclining with respect to a phantom radial line segment viewed from a side face of the tire. Therefore, there is a problem that each nylon cord or the like, particularly an outer end thereof in the radial direction is easily peeled off from rubber during repetitive rotation of the tire under loading, particularly due to deflection deformation of the bead portion and sidewall portion.

[0004] Also, such a chafer is apt to easily cause deformation, peeling or the like of the cord in the outer portion in the radial direction, which increases a size increasing quantity, accompanied with the increase of winding radius during the formation of a green tire, particularly at a shaping step thereof. As a result, the chafer is arranged only in the vicinity of the bead core. Furthermore, an extending angle of the nylon cord or the like and an arranging width of the chafer in the radial direction are changed by the increase of the winding radius at the shaping step, and also an arranging density of the nylon cord or the like after the completion at the shaping step gradually decreases toward the outside of the chafer in the radial direction, so that it is difficult to give the expected rigidity to the bead portion.

[0005] Attention is also drawn to the disclosure of EP-A-0724973 corresponding to the preamble of claim 1.

[0006] It is, therefore, an object of the invention to solve the aforementioned problems of the conventional technique and to provide a heavy duty pneumatic tire capable of sufficiently realizing a desirably adequate rigidity in a bead portion by eliminating a likelihood of peeling of cord and arranging cords in required position and form as is expected in this type of reinforcing layer arranged along the bead filler.

[0007] According to the invention, there is provided a heavy duty pneumatic tire comprising a bead portion, a carcass wound around a bead core having a polygonal form at its cross section from the inside of the tire toward the outside thereof in a radial direction, and a bead filler arranged on an outer periphery of the bead core between a main portion and a turnup portion of the carcass, characterized in that at least two reinforcing layers each comprised of an organic fiber cord(s) or a metal wire(s) extended substantially in a circumferential direction of the tire are arranged at given intervals in the radial direction of the bead filler.

[0008] In the invention, the reinforcing layer may have a structure wherein a plurality of circular rings each made of the organic fiber cord or the metal wire are arranged concentrically, but it is preferable to have a spirally wound structure of one or more organic fiber cords or metal wires.

[0009] In the tire according to the invention, the organic fiber cord constituting the reinforcing layer, for example monofilament cord or multifilament cord is extended substantially in the circumferential direction of the tire, whereby the exposing of cord ends as described in the conventional technique can be prevented and also the peeling of these cord ends can effectively be prevented. This is particularly remarkable when the reinforcing layer has a concentrically arranging structure of plural rings or a spirally wound structure.

[0010] Also, the reinforcing layer comprised of the cord extending substantially in the circumferential direction of the tire effectively contributes to increase the rigidity of the bead portion in various directions of the tire such as up and down directions and lateral direction and front and back directions. Particularly, the reinforcing layer can largely increase the rigidities in the lateral and front and rear directions of the tire among the above rigidities to ensure the realization of excellent steering stability.

[0011] When the reinforcing layer has the spirally wound structure of one or more organic fiber cords or metal wires, it can simply be formed by spirally and continuously winding the cord and also such a wound form can easily be maintained. Therefore, the reinforcing layer can be simply, easily and accurately arranged in a given position of a green tire and hence a product tire without damaging the wound form of the cord by applying the reinforcing layer to a required position of the bead filler on the bead core through adhesion or the like prior to folding the turnup portion of the carcass, the sidewall portion and the like in the building of the tire, e.g. at the shaping step, or by setting the bead filler provided with the bead core and applied on the required portion with the reinforcing layer at a given position in a stand-up posture. Thus, the rigidity of the bead portion can be increased as required, and also it is easy to incorporate such a bead portion rigidity in the design of the tire.

[0012] The reinforcing layer may be arranged in at least one of inner and outer sides of the bead filler.

[0013] The invention will be further described with reference to the accompanying drawings, wherein:

FIG. 1 is a diagrammatically right-half section view of an embodiment of a pneumatic tire;

FIG. 2 is a schematically section view of a main part of another embodiment;

FIGS. 3a to 3c are schematically section views of

main parts of embodiments of the invention, respectively; and

FIG. 4 is a schematically section view illustrating an embodiment of manufacturing the pneumatic tire according to the invention.

[0014] In FIG. 1 is sectionally shown a right-half of an embodiment of a heavy duty radial tire, according to the invention, wherein numeral 1 is a tread portion, numeral 2 a sidewall portion extending inward from a side end of the tread portion 1 in a radial direction, numeral 3 a bead portion connecting to an inner peripheral side of the sidewall portion 2, and numeral 4 a carcass toroidally extending to reinforce these portions 1, 2 and 3.

[0015] In this embodiment, a turnup portion 4a of the carcass 4 is wound around a bead core 5 embedded in the bead portion 3 and having a hexagonal form at its section from the inside of the tire toward the outside thereof in the radial direction and fixed outward in the radial direction. Also, a belt 6 comprised of plural belt layers is arranged on an outer peripheral side of a crown portion of the carcass 4.

[0016] Further, a bead filler consisting of hard and soft rubber stocks is arranged on an outer peripheral side of the bead core 5 between a main portion 4b and the turnup portion 4a of the carcass 4. In the illustrated embodiment, a reinforcing layer 8 is adjoined to an outer face of the bead filler 7 and arranged over substantially the whole of the bead filler 7 in the radial direction. The reinforcing layer 8 is comprised of an organic fiber cord or a metal wire extended substantially in a circumferential direction of the tire.

[0017] It is preferable that the reinforcing layer 8 takes a spirally wound structure of one or more organic fiber cords 8a. In the reinforcing layer 8 having such a structure, cord end is revealed only at inner and outer ends of the spiral in the radial direction. Moreover, when the reinforcing layer 8 has a structure of concentrically arranging a plurality of circular rings having different diameters, each of which rings being formed by endlessly connecting the organic fiber cord 8a or the like in a circular form or by overlapping end portions of the organic fiber cord 8a with each other in a circular form without connecting them, it is preferable to maintain the arranging state of these rings by connecting the plural rings to each other through a yarn or the like extending in the radial direction.

[0018] According to the tire having the above structure, the cord 8a or the like is extended substantially in the circumferential direction of the tire as mentioned above, so that peeling of the cord end from rubber can advantageously be prevented and also the rigidity of the bead portion 3 in various directions can sufficiently be increased as required.

[0019] Also the reinforcing layer 8 is applied on a side face of the bead filler previously set or post-set in a given position at a stand-up posture prior to the folding of the turnup portion 4a of the carcass 4 at a shaping step in the building of the tire, so that it can accurately be arranged in a given position of a green tire and hence a product tire at a desired state without being substantially influenced by the shaping step of a subsequent folding operation. As a result, the rigidity of the bead portion can simply, easily and properly be adjusted with a higher accuracy, or such a bead portion rigidity can be incorporated in the design of the tire.

[0020] In FIG. 2 is sectionally shown a main part of another embodiment of a tire, which is a modified embodiment of FIG. 1. That is, a reinforcing layer 9 is adjoined to an inner face of the bead filler and arranged over substantially the whole of the bead filler 7 in the radial direction.

[0021] Moreover, the rigidity of the bead portion can be more increased by arranging reinforcing layers adjacent to both inner and outer faces of the bead filler 7 in a combination of, for example, the arrangement shown in FIG. 1 and the arrangement shown in FIG. 2.

[0022] In FIGS. 3a to 3c are sectionally shown main parts of embodiments of tires according to the invention, respectively.

[0023] An embodiment shown in FIG. 3a has a structure wherein a reinforcing layer 8 adjoining to the outer face of the bead filler 7 is arranged so as to be biased inward in the radial direction and a reinforcing layer 9 adjoining to the inner surface of the bead filler 7 is arranged so as to be biased outward in the radial direction. According to this structure, a given rigidity can be applied to any position and also distortion can be controlled by adjusting such a rigidity. Particularly, the cords of the reinforcing layer 9 are directly crossed with ply cords of the carcass to form parallel crosses to thereby more increase the rigidity, while the reinforcing layer 8 directly controls the bending deformation around a rim flange at the outside of the bead filler 7 to improve the bead portion durability.

[0024] An embodiment shown in FIG. 3b has a structure wherein a reinforcing layer 10 adjoining to the outer surface of the bead filler 7 is comprised of an inner peripheral segment 10a and an outer peripheral segment 10b arranged at a given interval in the radial direction of the bead filler 7. In this case, the distortion deformation can be more advantageously prevented by the outer peripheral segment 10b.

[0025] An embodiment shown in FIG. 3c has a structure wherein a reinforcing layer 11 adjoining to the inner surface of the bead filler 7 is comprised of an inner peripheral segment 11 a and an outer peripheral segment 11b arranged at a given interval in the radial direction of the bead filler 7 in addition to the same reinforcing layer 10 as shown in FIG. 3b, wherein the interval between the segments in the reinforcing layer 11 is made larger than that in the reinforcing layer 10. According to the arrangements of the reinforcing layers 10 and 11, substantially the same function and effect as in FIG. 3b can be developed, but also the rigidity can be more increased by the parallel crosses between the cords of the reinforcing lay-

er 11 and ply cords of the carcass and also the bending deformation of the carcass can be restricted.

[0026] In the embodiments of FIGS. 3a to 3c, the same function and effects as shown in FIG. 1 can naturally be developed.

[0027] As sectionally shown in FIG. 4, the tire having the above structure can be manufactured by setting a bead filler 34 previously adhered with reinforcing layers 32, 33 in given positions at a stand-up posture together with a bead core 35 onto a given position of a former prior to the folding of portions 31 of the carcass, sidewall and the like at a shaping step in the building of the tire and thereafter continuing the shaping step such as the folding of the portions 31 to incorporate the reinforcing layers 32, 33 into a green tire.

[0028] As mentioned above, according to the invention, the peeling of end portion of the cord or wire constituting the reinforcing layer can effectively be prevented to largely improve the bead portion durability, and also the rigidities of the bead portion in various directions can be adjusted simply and easily as expected.

Claims

1. A heavy duty pneumatic tire comprising a bead portion (3), a carcass (4) wound around a bead core (5) having a polygonal form at its cross section from the inside of the tire toward the outside thereof in a radial direction, and a bead filler (7) arranged on an outer periphery of the bead core (5) between a main portion (4b) and a turnup portion (4a) of the carcass (4), **characterized in that** at least two reinforcing layers (8;9;10;11) each comprised of an organic fiber cord (s) or a metal wire(s) extended substantially in a circumferential direction of the tire are arranged at given intervals in the radial direction of the bead filler (7).

2. A pneumatic tire as claimed in claim 1, **characterized in that** the reinforcing layer (8) is a spirally wound structure of one or more organic fiber cords (8a) or metal wires.

3. A pneumatic tire as claimed in claim 1, **characterized in that** the reinforcing layer (8;9;10;11) is arranged at at least one of inner and outer sides of the bead filler (7).

Patentansprüche

1. Luftreifen für hohe Beanspruchungen, der Folgendes umfasst: einen Wulstabschnitt (3), eine Karkasse (4), die von der Innenseite des Reifens in Richtung auf seine Außenseite in radialer Richtung um einen Wulstkern (5) mit einer polygonalen Querschnittsform gewickelt ist, und einen Kernreiter (7), der an einer Außenperipherie des Wulstkerns (5) zwischen einem Hauptabschnitt (4b) und einem Umschlagabschnitt (4a) der Karkasse (4) angeordnet ist, **dadurch gekennzeichnet, dass** wenigstens zwei Verstärkungslagen (8; 9; 10; 11) jeweils aus (einem) organischen Faserkord(en) oder (einem) Metalldraht/-drähten bestehen, der/die im Wesentlichen in einer Umfangsrichtung des Reifens verläuft/verlaufen, in bestimmten Intervallen in der radialen Richtung des Kernreiters (7) angeordnet sind.

2. Luftreifen nach Anspruch 1, **dadurch gekennzeichnet, dass** die Verstärkungslage (8) eine spiralförmig gewickelte Struktur aus einem oder mehreren organischen Faserkorden (8a) oder Metalldrähten ist.

3. Luftreifen nach Anspruch 1, **dadurch gekennzeichnet, dass** die Verstärkungslage (8; 9; 10; 11) auf der Innen- und/oder der Außenseite des Kernreiters (7) angeordnet ist.

Revendications

1. Bandage pneumatique pour poids lourds comprenant une partie de talon (3), une carcasse (4) enroulée autour d'une tringle (5) possédant une forme polygonale au niveau de sa section transversale à partir de l'intérieur du pneumatique vers l'extérieur de celui-ci dans la direction radiale, un bourrage sur tringle (7) agencé sur la périphérie extérieure de la tringle (5) entre une partie principale (4b) et une partie de retournement (4a) de la carcasse (4), **caractérisé en ce que** au moins deux nappes de renforcement (8;9;10;11) chacune composée de câblé(s) en fibre organique ou de fil(s) métallique(s) s'étendant pratiquement dans la direction circonférentielle du pneumatique sont agencées à intervalles donnés dans la direction radiale du bourrage sur tringle (7).

2. Bandage pneumatique comme revendiqué dans la revendication 1, **caractérisé en ce que** la nappe de renforcement (8) est une structure enroulée en spirale d'un ou de plusieurs câblés en fibre organique (8a) ou de fils métalliques.

3. Bandage pneumatique comme revendiqué dans la revendication 1, **caractérisé en ce que** la nappe de renforcement (8;9;10;11) est agencée au niveau d'au moins un des côtés intérieur et extérieur du bourrage sur tringle (7).

FIG. 1

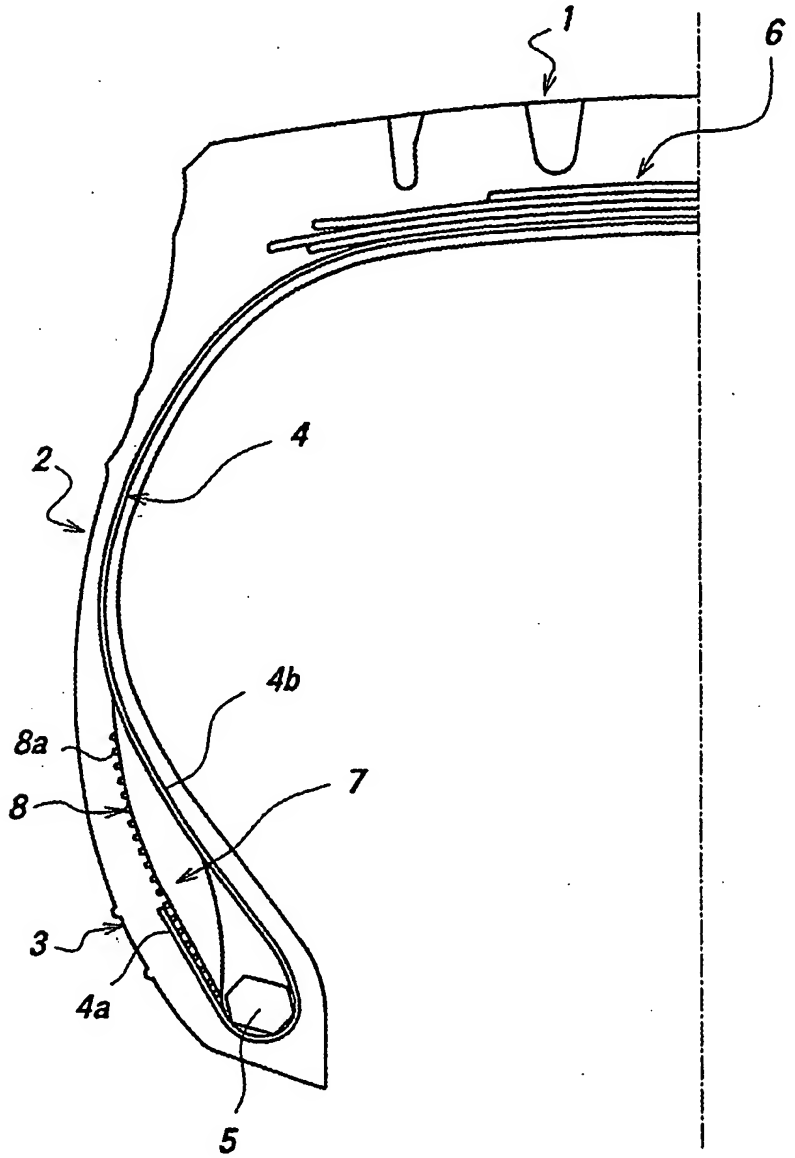

FIG. 2

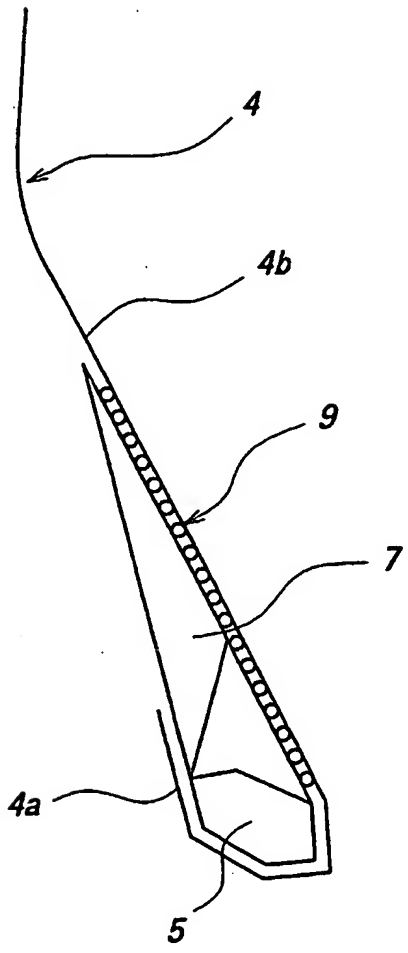

FIG. 3a

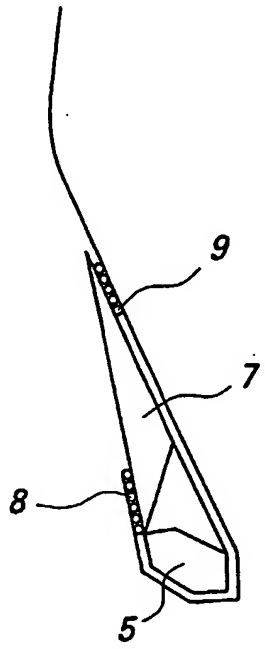

FIG. 3b

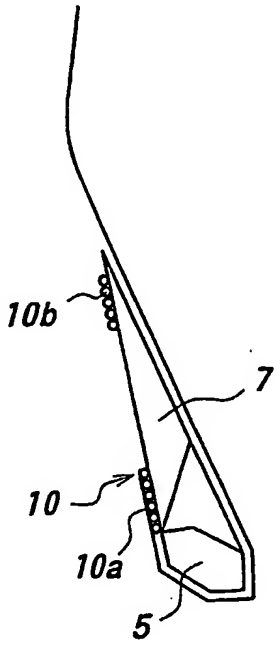

FIG. 3c

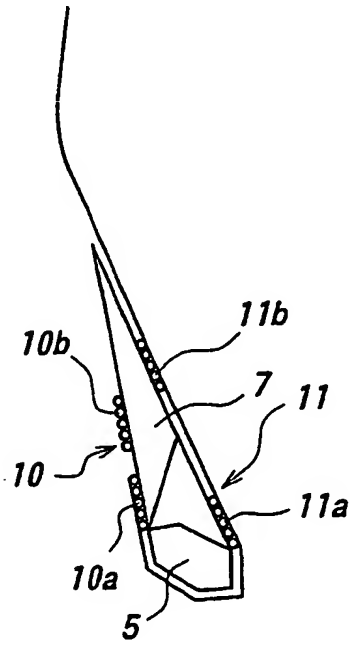

FIG. 4